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Carcass composition of exotic sheep breeds

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ABSTRACT

The carcass composition of pasture-fed crossbred ram lambs of the Finn, Texel, Oxford Down, Border Leicester and Suffolk breeds was compared at the Hopuhopu Animal Quarantine and Research Station in 1987. Early results were in close agreement with overseas studies which have highlighted the low subcutaneous fat depth of Texel crossbreds in comparison with lambs from Suffolk sires at the same carcass weight. Finn crossbreds were relatively lean subcutaneously but had relatively more kidney fat. Texel crosses showed superior eye muscle development at constant carcass weight.

Keywords Breeds; body composition; carcass measurements.

INTRODUCTION

Improvements in prolificacy, milking ability, growth rate, lean meat production and the distribution of fat, muscle and bone within the carcass were considered to be desirable features for consideration of new breeds for importation to New Zealand. The Maximum Security Quarantine Advisory Committee which was appointed by the Minister of Agriculture to review the need for new sheep breeds considered these features and in 1983 identified the Finnish Landrace (Finn), East Friesian, Oxford Down (Oxford), North American Suffolk and Texel breeds as having 1 or more of these features. Ministry of Agriculture and Fisheries veterinarians and scientists investigated a number of alternative overseas sources and recommended the importation of Finn, Texel and Oxford sheep from Denmark and Finland in 1984. To facilitate sampling, transport and to minimise the risk of disease hazards, emphasis was placed on the collection of genetic material as frozen embryos and semen (Tervit *et al.*, 1986).

Embryos and semen were implanted into Coopworth ewes held on the Maximum Security Quarantine Station (Somes Island), in the autumn of 1985 and generated the rams used for the experimental comparisons described in this paper. Additional embryos were implanted into Coopworth and Romney ewes in 1985 to further increase the numerical strength of the nucleus flocks being then held under secondary quarantine at the Hopuhopu Animal Research and Quarantine Station near Hamilton.

MATERIALS AND METHODS

To provide for early performance comparisons a crossbreeding comparison was set up at Hopuhopu in 1986. In the autumn of that year, 10 Finn rams, 9

Oxford rams and 9 Texel rams were chosen for mating as lambs in balanced single-sire mating groups to Romney and Coopworth ewes. In addition, semen from 5 rams each of the Border Leicester (Border) and Suffolk breeds being used in sire-breed comparison trials at the Rotomahana Research Station, was also used for single-sire matings to similar samples of Romney and Coopworth ewes. Through sire referencing this design aims to provide genetic links to rams in other sire-breed evaluation studies.

This paper reports preliminary results from carcass analyses carried out on 214 ram lambs killed in 2 slaughter groups in March 1987. They represent the progeny of Texel, Finn and Oxford rams chosen to given wide representation of the available sire-families and above average performance for early growth which were reared indoors on concentrates at Somes Island to December 1985 and gradually adapted to a pasture environment at Hopuhopu in 1986. Rams of the Suffolk and Border breeds providing semen for comparative progeny assessment were 2-tooth rams chosen from industry flocks and were also of above-average growth performance merit in their flock of origin.

Crossbred lambs were weaned onto pasture from pasture-fed ewes at approximately 10 weeks of age and remained on pasture until slaughter at an average age of 29 weeks. In December 1986 the crossbred ram lambs were dosed with sporidesmin to determine their tolerance to this toxin on the basis of their response in plasma gamma glutamyl transferase levels (GGT), following the method of Towers *et al.* (1983). A small number of lambs showing highest GGT reaction to this test and a small number of high growth rate crossbreds retained for breeding were excluded from the carcass evaluations described.

Carcass data included in this report are confined to linear measurements taken on the cut carcasses. Chemical components, joint weights and broad tissue components determined by routine carcass cutting procedures are still being gathered for analysis. Subcutaneous fat depth measurements were taken in the shoulder (S₁, S₂), loin (C, J) and leg (L₂, L₃) regions of the carcass (Kirton *et al.*, 1967). Tissue depth measurement GR (Kirton and Johnson, 1979) was also taken as were the linear measurements F, T (Pálsson, 1939), and measures of leg length (LL) (Kirton and Pickering, 1967) and carcass length (CL) (Moxham and Brownlie, 1976).

Data were analysed using a least squares model which included terms for sire breed, sire, dam breed, slaughter group, GGT reaction (4-levels) and covariates associated with linear breed and slaughter group effects of carcass weight. Other analyses which included interaction among these effects gave no important improvement to the descriptive power of the linear model.

The extent of the lambs' GGT reactions to sporidesmin had a significant and negative effect on

several of the adjusted fat-depths, but seems unlikely to have influenced breed ranking which were essentially the same when 34 lambs in 2 of the 4 categories showing the most marked GGT effects were excluded from the analysis of adjusted breed effects.

RESULTS

Average growth differences among crossbreds are best indicated by undosed contemporaneous female lambs in January 1987. Unadjusted body weights (average 26.6 kg) were similar for Finn, Texel and Border Leicester crosses which were about 9% lighter than Oxford and Suffolk crosses. Mainly because of differences in average birth date between naturally and artificially mated sires, adjusted body weights gave different relative breed rankings: Oxford (106), Suffolk and Finn (100), Texel (96) and Border Leicester (92).

Adjusted fat depths by sire breed, relative to Suffolk cross lambs, are presented in Table 1. Averaged over all 6 fat depths, Border and Oxford crossbred lambs were 7% leaner than Suffolk

TABLE 1 Carcass characteristics adjusted for carcass weight of crossbred ram lambs by breed of sire and relative to Suffolk crosses (100) (see text for definition of measurements).

| Breed of sire | GR | Shoulder | | Loin | | Leg | |
|---------------------------|-------|----------------|----------------|-------|-------|----------------|----------------|
| | | S ₁ | S ₂ | C | J | L ₃ | L ₂ |
| Finn | 76 | 52 | 68 | 62 | 68 | 74 | 54 |
| Texel | 73 | 78 | 71 | 62 | 68 | 86 | 46 |
| Oxford | 93 | 98 | 96 | 85 | 82 | 112 | 87 |
| Border | 109 | 85 | 95 | 96 | 102 | 91 | 87 |
| Suffolk ¹ | 7.28 | 1.16 | 4.43 | 2.92 | 6.77 | 4.57 | 4.30 |
| ² | ±0.49 | ±0.22 | ±0.41 | ±0.27 | ±0.45 | ±0.52 | ±0.39 |
| RSD ³ | 2.07 | 0.95 | 1.72 | 1.14 | 1.91 | 0.21 | 1.63 |
| Significance ⁴ | *** | NS | ** | *** | *** | * | *** |

| Eye muscle (cm) | | | Length (cm) | | | | Kidney fat (kg) |
|-----------------|-------|------|-------------|------|------|------|-----------------|
| A | B | AxB | F | T | CL | LL | |
| 101 | 95 | 96 | 108 | 106 | 103 | 104 | 131 |
| 105 | 102 | 107 | 101 | 102 | 99 | 99 | 75 |
| 101 | 100 | 102 | 101 | 101 | 100 | 99 | 97 |
| 96 | 100 | 97 | 104 | 102 | 101 | 102 | 101 |
| 5.36 | 2.64 | 14.1 | 26.2 | 19.3 | 98.4 | 44.0 | 0.206 |
| ±0.08 | ±0.04 | ±0.3 | ±0.2 | ±0.1 | ±0.4 | ±0.3 | ±0.014 |
| 0.32 | 0.18 | 1.3 | 0.9 | 0.6 | 1.7 | 1.3 | .058 |
| *** | ** | *** | *** | *** | *** | *** | *** |

¹ Least squares mean.

² Standard error.

³ Residual standard deviation.

⁴ Significance of adjusted sire breed means.

crosses. Texel and Finn crosses were considerably leaner (30-40%) in comparison with Suffolk crosses. While sire breed effects on the carcass weight covariate were significant only for L2, Finn- and Texel-sired lambs in particular showed consistently low regression coefficients in comparison with other breed crosses indicating greater leanness advantages for heavier compared to lighter animals. This is illustrated (Fig. 1) by the breed rankings for measurement C for animals adjusted along the average sire-breed regression lines to 15 kg compared with 20 kg carcass weight. (The average carcass weight at slaughter was 17 kg).

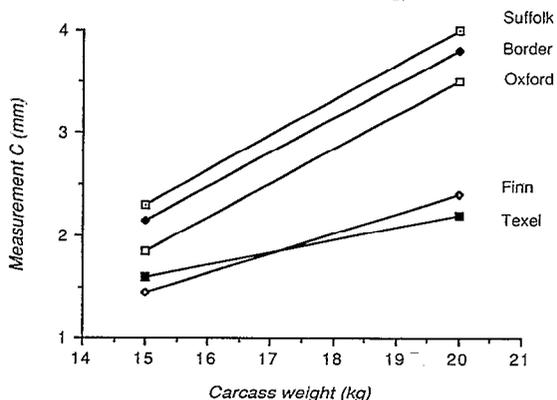


FIG. 1 Estimated fat depths (C, mm) at carcass weights of 15 kg and 20 kg.

Data in Table 1 also suggests evidence of breed differences in the distribution of subcutaneous fat. At the same carcass weight, Finns appear to be relatively leaner for the more ventral fat depth measurements (S_1 compared with S_2 ; C compared with J) and in the shoulder area compared with the loin and leg. Oxfords appear to be somewhat leaner and Borders somewhat fatter in the loin compared with their ranking relative to Suffolks at the shoulder and leg sites. The leanness advantage of Oxford over the Border crosses was particularly pronounced in the loin region and for the GR measurement.

Sire breeds ranked differently for kidney fat weight than for subcutaneous fat depth, overseas evidence of the propensity for Finns to lay down internal fat being confirmed by these results (McClelland and Russel, 1972). By contrast the Texel ranked lean for this fat depot as well.

Breed rankings for eye muscle dimensions were most marked for the Texel, once again in line with overseas evidence (Wolf *et al.*, 1980). The transverse breadth measurement (A) showed greatest variation among breeds and with live weight was responsible for the superiority of Oxford over Border crosses.

Leg and carcass length measurements showed that Finn-sired lambs were most divergent having

relatively longer legs even than Border crossbreds. Sire breed differences in adjusted joint weights were small; they will be analysed in greater detail when further data become available.

DISCUSSION

Because of the linear model used for analysis, the sire-breed means reported are in effect averaged over the 2 dam breeds and 2 slaughter groups involved in the experiment. They are also averaged over the 4 GGT-response categories that occurred following sporidesmin dosing. Breed rankings are believed to be independent of these effects, the discussion of which is outside the scope of this preliminary report.

In broad terms the results observed are in line with similar investigations reported from the United Kingdom (Wolf *et al.*, 1980; Wolf and Smith, 1983; Kempster *et al.*, 1987) and Ireland (Hanrahan, 1982). In their studies Texel crosses had significantly less fat than Suffolk crosses (79% and 83% of the Suffolk mean, respectively). The regression coefficients observed here also indicate that Texel sired lambs which grew faster and/or were older than average, were also relatively more lean than the corresponding heavier lambs of the other breeds. This suggests that the leanness advantage of Texels may be more pronounced for lambs taken to heavier carcass weights.

GR measurements closely reflect the average fat-depth rankings for Texel, Oxford and Suffolk crosses but Finn and Border crosses were somewhat leaner than expected from their relative GR ranking. Further evaluation of GR as a predictor of carcass fat content will be undertaken when additional carcass composition data becomes available.

The low subcutaneous fatness of Finn crossbred lambs was also most noticeable in these results but the leanness characteristic did not extend to the kidney fat depot. Finn crossbreds also produced leggier carcasses at the same carcass weight.

Eye muscle dimensions for Oxford and Suffolk crosses were intermediate between the extremes set by the Finn and Border (low) and Texel (high) crossbreds. The advantage of Texel crosses over Suffolk crosses agreed closely with the results obtained by Wolf *et al.* (1980). In overseas trials this advantage has been accompanied by significantly greater weights of lean in carcasses of the same weight in comparison with most other breeds (Wolf and Smith, 1983; Kempster *et al.*, 1987). Oxford crosses also displayed eye muscle superiority at constant carcass weight, especially over Border crosses.

There is remarkable agreement between these results and overseas studies in which the Texel breed has been compared, mainly against the Suffolk. The overall impact of the results to the potential of the Texel to lamb production in this country is further

strengthened, by its low GR and high eye muscle development in relation to the Border Leicester and its white-wool features in comparison with the Suffolk.

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